10.0 REGULATORY OPTIONS AND ANALYSIS

This task establishes options that the FAA or other regulators can use to make OEMs, STC holders and operators comply with WFD audits of specific models if voluntary means fail since WFD is an airworthiness concern.

10.1 REGULATORY OPTIONS

Possible regulatory actions identified by the AAWG include the following options:

- Task ARAC to develop FAR 121 Operating Rule and Guidance Advisory Circular
- Issue FAR 25.1529 rule change requiring OEMs to develop new airworthiness limitations for WFD prone design details.
- Issue model specific airworthiness directives to require modification of identified WFD prone design details.
- Issue model specific airworthiness directives to require inspection of identified WFD prone design details.
- Issue FAR 121 Operating Rule to require operators to revise their maintenance programs to include additional Supplemental Structural Inspection Programs.
- Issue model specific airworthiness directive to mandate flight cycle service limitations
- Revoke production certificate of non compliant OEM
- Limit production of spare parts by noncompliant OEM
- Increase OEM liability for the type design.

10.2 RELATIVE MERITS OF EACH OPTION

The advantages and disadvantages of each regulatory option in establishing effective WFD prevention are listed in the Tables 10.1 through 10.10.

Table 10.1 — Relative Merits of Regulatory Options
Task ARAC to develop FAR 121 Operating Rule and Guidance Advisory Circular

Option	Advantages	Disadvantages
Task ARAC to develop FAR 121 Operating Rule and Guidance Advisory Circular	Rulemaking is more appropriate than AD, if WFD is not an immediate airworthiness concern	Long time to develop, mandate and implement program
	Single rule can cover all affected airplane types Rulemaking process provides firm notice of intentions in time to consider courses of action	Limited technical content without OEM Participation Will not address fleet types or design details of immediate airworthiness concern
	Industry infrastructure (model specific) already exists to develop and implement WFD program with AAWG oversight	Costly to operators (may be necessary for operator to bear entire cost of program development)
		Limited industry technical skills available to develop program without OEM participation
		Limited industry ability to validate program without OEM participation
		Uniform compliance among all global operators questionable
		Variations in program development and implementation between fleet types .

Table 10.2 — Relative Merits of Regulatory Options
Issue airworthiness directives to require modification of WFD prone design details

Option	Advantages	Disadvantages
Issue airworthiness directives to require modification of WFD prone design details	Not dependent on development of inspection program	Problem not rigorously demonstrated by analysis for each model specific detail resulting in overly conservative thresholds
	Very effective (addresses all design details of concern)	Most costly option to operators
	Global acceptance	Long out-of-service times required to accomplish modifications
	Permanent Fix	Extensive analysis and validation required to identify modifications beyond part replacements
		Arbitrary compliance time without rigorous analysis (may be unconservative) Problems with materials without OEM participation
		Special skill requirements to replace parts to original build standards
		Long lead times on parts and tooling
		Limited modification facilities (industry operating at current capacity)
		Limited shoring and tooling available to put airplanes into jig position for modification
		Extrusions or forgings may be obsolete
		Special fastener and coldworking tool shortages
		Airplanes already beyond DSG

Table 10.3 — Relative Merits of Regulatory Options

Issue FAR 25.1529 revision requiring OEMs to develop new airworthiness limitations for WFD prone design details

Option	Advantages	Disadvantages
Issue FAR 25.1529 revision requiring OEMs to develop new airworthiness limitations for WFD prone design details	Precedence for rulemaking, i.e. existing certification requirement	Dependent on OEM participation
	Requires analysis of individual design details instead of shot-gun approach	Long time to develop, mandate (requires regulatory harmonization) and implement program
	OEM Rule	
	Covers old and new certification programs	Will not address fleet types or design details of immediate airworthiness concern (additional rulemaking required)
	Recertification required beyond fixed service limit	Requires additional rulemaking to address repaired structure
	Applicable to STC s	Options dependent on the development and validation of NDI technology

Table 10.4 — Relative Merits of Regulatory Options

Issue model specific airworthiness directives to require inspection of WFD prone design details

Option	Advantages	Disadvantages
Issue model specific airworthiness directives to require inspection of WFD prone design details	Addresses all design details	Requires development of extensive inspection program (identification of critical flaw sizes and locations) and validation of NDI techniques
	Addresses specific fleets of concern	Limited technical merit without OEM participation
	Rapid implementation	Must be demonstrated airworthiness concern
	Perception of doing something	Assures only short term airworthiness (arbitrary probability of detection leading to missed cracks)
		Doubtful global effectiveness (Large areas to be inspected)
		Conservative inspection intervals necessary without extensive analysis
		Very costly (NDI equipment/schedule disruptions/excessive analysis)
		NDI technology may not be ready
		Specific skills required to apply
		Limited availability of specialized NDI equipment
		No permanent fix
		Unacceptable risk associated by management of MSD/MED with only inspections
		Some design details may not be inspectable (hidden details)

Table 10.5 — Relative Merits of Regulatory Options

Issue a FAR 121 Operating Rule requiring incorporation of new Supplemental Structural Inspections into operators maintenance program

Option	Advantages	Disadvantages
Issue a FAR 121 Operating Rule requiring incorporation of new Supplemental Structural Inspections into operators maintenance program	Rule is more appropriate than airworthiness directive since immediate airworthiness concern has not been demonstrated	Long time to develop, mandate and implement program requiring
	Precedence for SSIPs	Will not address immediate airworthiness concerns
	Covers all concerned fleets with singe rule	Inflexible (slow process to revise rule if needed)
	Existing industry infrastructure (model specific STG s) to develop program with AAWG oversight	Requires OEM participation to develop effective large scale program (many design details)
	Addresses only specific design details shown by analysis to be of WFD concern instead of shot-gun approach	Requires rigorous analysis and data, along with validation
	Operator options to customize program to their mission and maintenance program using program guidelines	Requires FAA PMI oversight for uniform application
	Establishes service limit for noncompliance	Arbitrary compliance time to address the effect of repairs and design changes
		Requires rigorous inspection program and NDI development
		Requires threshold validation
		Does not address design details that cannot be reliably managed with inspections

Table 10.6 — Relative Merits of Regulatory Options
Issue model specific airworthiness directives to mandate operational limitations

Option	Advantages	Disadvantages
Issue model specific airworthiness directives to mandate operational limitations	Can be issued quickly to address immediate airworthiness concern	Effectiveness difficult to determine without analysis
	Could be used to extend service life	Could impact other safety areas (ex. Air Traffic Control)
	Ensures global action	Negative publicity for operator and regulators (Certification deficiency implied)
	Does not rely on inspection of large areas	Limits mission of the airplane

Table 10.7 — Relative Merits of Regulatory Options
Issue model specific airworthiness directive to mandate flight cycle service limitations

Option	Advantages	Disadvantages
Issue model specific airworthiness directive to mandate flight cycle service limitations	Addresses immediate airworthiness concern	Economic disadvantages to operators
	Total safety ensured, if retirement set to right value (flight cycle limit)	Limit must be set to conservative flight cycles without rigorous analysis
	Fleet strategic planning simplified	Safe life may be misconstrued to mean that airplanes are safe without continuing surveillance and assessment
		May result in less maintenance as airplanes approach fixed retirement cycle limit (increase in deferred maintenance)
		Production capacity limits mass replacement of large number of airplanes

Table 10.8 — Relative Merits of Regulatory Options
Revoke production certificate of noncompliant OEM s

Option	Advantages	Disadvantages
Revoke production certificate of noncompliant OEM s	Provides economic incentive to OEM to complete WFD program	Not Effective, if OEM is forced out of business Adverse impact on safety if OEM is out of business Not in public interest Does not improve safety (airplanes of concern still operating) Legal constraints for implementation

Table 10.9 — Relative Merits of Regulatory Options
Limit production of OEM spare parts

Option	Advantages	Disadvantages
Limit production of OEM spare parts	Provides economic incentive to OEM to complete WFD program	Penalizes operators of low utilization airplanes that would not otherwise be affected by WFD program Economic burden to both operators & OEMs Parts would be sourced to other manufacturers raising bogus parts and other quality issues Does not improve safety (airplanes of concern still operating) Legal constraints for implementation

Table 10.10 – Relative Merits of Regulatory Options

Increase OEM liability for the type design

Option	Advantages	Disadvantages
Increase OEM liability for the type design	Economic incentive to OEM to complete WFD program	Not effective, if the OEM is not in business Legal constraints for implementation Does not improve safety (airplanes of concern still operating)

10.3 RANKING OF APPLICABLE OPTIONS

While all of the options considered have some merit in addressing WFD issues, some of the issues were less appropriate since they do not actually address the WFD concern. Specifically the options considering penalties against the OEM and STC Holders have no real influence in whether or not airplanes could be operated with active MSD/MED. For this reason, these options will not be considered further. The remaining options all have some considerable benefit in addressing WFD concerns and are all appropriate considering when and how they could be used. Therefore the recommendations contained herein address a suite of potential actions that regulators could use in addressing WFD concerns. These recommendations are split between short and long term actions.

The proposed regulatory options are grouped into short term and long term options, and ranked by terms of effectiveness to prevent WFD. The options also reflect regulatory actions that may be imposed.

10.3.1 Short Term Actions
(Ranked in order of effectiveness)

- Issue model specific airworthiness directives requiring inspection of design details susceptible to develop MSD/MED.
- Issue model specific airworthiness directives requiring modification or replacement of design details susceptible to develop MSD/MED.
- Issue model specific airworthiness directives establishing operating limitations.
- Issue model specific airworthiness directives establishing flight cycle service limitations.

10.3.2 Long Term Actions
(Ranked in order of effectiveness)

- Issue a FAR 121 Operating Rule and Guidance Advisory Circular for the development of model specific WFD programs.
- Issue FAR 121 Operating Rule requiring operators to revise their maintenance programs to include additional Supplemental Structural Inspection Programs.
- Issue FAR 25.1529 rule change requiring OEMs and STC Holders to develop new airworthiness limitations for WFD prone design details.

10.4 PROPOSAL FOR RULEMAKING

From the list above, a total of eight slightly modified proposals were considered for rulemaking.

- FAR 121 Operation Rule that set flight cycle limits for airplanes on a fleet by fleet basis unless the maintenance program at the operator is amended to include additional instructions for continued airworthiness.
- Revise FAR 25.1529 to include provision to limit the validity of the instructions for continued airworthiness for future certification programs.
- Issue Airworthiness Directives to inspect/modify structure to correct immediate safety concerns as a result of findings under either program above.
- Issue ADs to impose operational limits, where effective, to limit the possibility of failure due to WFD.
- Issue ADs to impose service limits where other remedies are not effective.
- Revoke production certificate of non-compliant OEM and STC Holders.
- Limit production of spare parts by non-compliant OEM and STC Holders.
- Increase OEM and STC Holders liability for the type design.

Of the eight, only the first five were considered appropriate for consideration.

The last three were not responsive to the safety concern and therefore not considered further. Of the first five, all five were considered to address WFD issues. The proposed recommendation for rulemaking is divided between short and long-term remedies.

10.4.1 Long Term Remedies

A new FAR 121 Rule that affects all existing fleets of airplanes. The rule would limit the use of the airplanes on a fleet by fleet basis unless the maintenance program at the operator is amended to include additional instructions for continued airworthiness specifically directed towards prevention and correction of widespread fatigue damage. Maintenance program modifications would include additional inspection requirements as well as references to modification requirements most likely made mandatory via ADs.

Revise FAR 25.1529 to include provision to limit the validity (in terms of flight cycles or flight hours) of the instructions for continued airworthiness. This revision would be applicable to all future certification programs. Before reaching the limit, the maintenance program would need to be re-evaluated for the possible inclusion of additional instructions for continued airworthiness. The additional instructions would be specifically directed towards prevention of widespread fatigue damage.

10.4.2 Short Term Remedies for Airworthiness Concerns

Issue Airworthiness Directives to inspect/modify structure to correct immediate safety concerns as a result of findings under either long-term program.

Issue ADs to impose operational limits, where effective, to limit the possibility of failure due to WFD.

Issue ADs to impose service life limits where other remedies are not effective.

10.4.3 Proposed 121 Rule Details

This proposed rule would be applicable to all existing fleets of airplanes certified to Part 25 or its predecessors. The rule would set a calendar time or flight cycle limit for the airplane type beyond which operation would not be allowed without FAA approved changes being made to the maintenance program for the prevention of WFD. The OEM would produce the FAA Approved changes with the assistance of both the operators and regulators. The maintenance program revisions would clearly state the limits of validity of the changes.

Maintenance program revisions would primarily be increased inspection requirements with any necessary structural modifications being mandated through ADs.

The FAR 121 (New) Rule will require an Advisory Circular.

10.4.4 FAR 25.1529 Rule Revision Details

This rule revision would only be applicable to new certification programs. The rule would require an OEM to declare limits of validity, in terms of flight cycles, for the structural maintenance program as part of the certification process.

Operation of the airplane would be prohibited past the stated limits without FAA Approved Changes to the maintenance program. Required changes to the maintenance program would be developed using an STG process. Program revisions for WFD would be similar to that required by the 121 Rule.

Specific immediate airworthiness concerns would be handled by AD.

The establishment of this rule revision may require an additional 121 rule to make operators comply with the limits established in the OEM maintenance program recommendations.

The FAR 25.1529 (Revised) Rule will require an Advisory Circular.

The proposed use of ADs is to handle specific immediate airworthiness concerns. These include but are not limited to:

- To address MSD/MED findings of inspection program implemented under the 121 (New) Rule or 25.1529 (Revised) Rule.
- To impose operational restrictions on airplanes that has exceeded the safe operational limits due to active MSD/MED in the fleet.
- To handle specific non-responsive OEMs in performing the required analysis.

10.5 AAWG PROPOSAL FOR RULEMAKING

The AAWG recommendation for proposed rulemaking consists of the following proposals:

- For Existing FAR Part 25 Transport Category Airplanes - A FAA 121 (New) Rule and/or Part 39 (Amended)
- For New Certification Programs
  - FAA 25.1529 rule revision
  - FAA 121 (New) Rule for Operator Compliance
- FAA AC for Both 121 (New) and 25.1529 (Revised) Rule

Based on this proposed rulemaking Task, The AAWG further proposed language for the Terms of Reference used to initiate the Tasking for the follow-on work. The following was proposed to the Regulators and accepted for use in the Terms:

> *"ARAC is tasked to develop regulations (14 CFR part 25 and part 121 et. al) to ensure that one year after the effective date of the rule (e.g. Dec. 31, 2002), no large transport category airplane (> 75,000 lbs. Gross Take off Weight) may be operated beyond the flight cycle limits to be specified in the regulation unless an Aging Aircraft Program has been incorporated into the operators maintenance program.*
>
> *The regulations and advisory material shall establish the content of the Aging Aircraft Program. This program shall cover the necessary special inspections and modification actions for the prevention of Widespread Fatigue Damage (WFD), Structural Modifications, Supplemental Structural Inspections Programs (SSIP)/Airworthiness Limitations Instructions (ALI), Corrosion Prevention and Control Programs (CPCP) and Structural Repairs. The regulations will also require the establishment of a limit of the validity of the Aging Aircraft Program where additional reviews are necessary for continued operation."*

The full recommendation made by the AAWG to ARAC is shown in Appendix G. This proposal was submitted to ARAC on December 10, 1998. The proposal was accepted.

10.6 ADVANTAGES AND DISADVANTAGES

Develop FAR 121 (New) Operating Rule / FAR 25.1529 (Revised) Rule Requiring Incorporation of New Supplemental Structural Inspections and/or Modification Requirements into Operators Maintenance Program for Prevention of WFD

Advantages	Disadvantages
Establishes service limit for maintenance programs	Service limits may be too conservative.
Covers all concerned fleets with a single new rule and revision to another rule.	Requires excessive time to develop, mandate and Implement, subsequent rule changes are slow. Does not affect all foreign operators. *
Infrastructure exists to develop model specific programs under AAWG (e.g. STG).	Requires OEM participation to develop effective large scale programs
Provides for operator flexibility in establishing programs for their fleets.	Requires uniform application of the rule by Individual FAA PMIs.
Model specific documents published by the OEM can specifically address susceptible structure.	Arbitrary compliance times to address repairs/STC changes.
Rule is most appropriate approach since no immediate airworthiness concern exists.	Does not address immediate airworthiness concern. Immediate concerns should be addressed by AD.

* FAA/JAA must find way to make proposed rules effective to all operators

The operators have the following additional concerns with this regulatory proposal.

- OEM Viability / Participation in Program Development
- Technology for detection of small flaws in large area inspections
- Lead time for parts/support of the OEM
- Largely dependent on PMI for uniform enforcement
- Rule implementation times critical to prevent grounding of airplanes
- Any Additional reporting requirements/infrastructure
- Validation of OEM closing actions